P3R Engineers Ltd.

Consulting Building Services Engineers

Hatchery
Preston Farm

Energy & Sustainability Statement

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1.0 EXECUTIVE SUMMARY

The proposed development is the construction of a new 2 storey office building, a new social hub building and the conversion of an existing agricultural building into workshops.

The development has been designed to achieve the highest of environmental performance standards to satisfy the Core Strategy and associated policies of the Sevenoaks District Council; the Core Strategy was adopted in 2011.

The principles of the energy hierarchy have been adopted - a 'Lean, Clean, Green' approach – and the development achieves an overall improvement in regulated emissions of approximately 63% over Part L 2013 minimum standard, through the adoption of passive design measures, high standards of insulation, and low carbon electric heating systems.

Additionally, this report describes the approach to achieving the Building Research Establishment's Environmental Assessment Model (BREEAM) rating of Very Good.

2.0 THE SITE AND PROPOSAL

The application site is in a rural location currently occupied by agricultural buildings.

The proposed development has the following key characteristics:

- Gross floor area of approximately 1500m^2 split across 2 buildings.
- Building B1 is a two storied building which consists of offices, meeting rooms and toilets.
- Building B2, is a single storied standalone building which consists of socialising space, flexible working space and café.

A third building B3, is the refurbishment of an existing farm building into a workshop building and will be designed to meet the energy performance standards of Building Regulations Part L2B – existing buildings

Site location – Agricultural buildings and cottages

2.1 Local Planning Context

The project is located within the boundaries of Sevenoaks District Council.

The key planning guidance is contained within the Core Strategy (adopted 2011): Strategic Policy SP2 Sustainable Development sets the principle for sustainable development.

Overarching Principles - Sustainable Development

The District will contribute to reducing the causes and effects of climate change by promoting best practice in sustainable design and construction to improve the energy and water efficiency of all new development and contribute to the goal of achieving zero carbon development as soon as possible.

All new commercial (A1-A5, B1-2, B8, C1, D1) and institutional (C2, D1) development, (including conversions) and conversions to residential use will be required to achieve BREEAM "Very Good" standards increasing to "Excellent" standards from 2013 and must incorporate sustainable drainage systems (SUDS) where practical together with arrangements to secure their long term maintenance.

Achievement of the Code levels and BREEAM standards must include at least a 10% reduction in the total carbon emissions through the on-site installation and implementation of decentralised, renewable or low-carbon energy sources.

3.0 ENERGY ASSESSMENT

This report will consider the scheme against the above noted polices by implementing the methodology as set out in the generally adopted London Plan Energy Hierarchy.

Application of the Energy Hierarchy sets out how any development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following 3 stage analysis:

1 - Be lean: use less energy

2 - Be clean: supply energy efficiently

3 - Be green: use renewable energy

This scheme will be designed to limit the emissions of carbon dioxide to atmosphere from the operation of the building services as per the 'Energy Hierarchy'; the first step in which, as set out above requires that buildings be designed to use improved energy efficiency measures – Be Lean. This will reduce demand for heating, cooling, and lighting, and therefore reduce operational costs while also minimizing associated carbon dioxide emissions.

In order to do this, the "Baseline" energy demand must be established. This is the energy consumption and associated emissions from the development meeting only the minimum standards required under the Building Regulations.

The energy requirements for space heating, water heating and ventilation within the commercial space have been calculated using the National Calculation Method (NCM) in line with Approved Document L2A of the Building Regulations 2013 and the Non-Domestic Heating Compliance Guide.

The Government approved assessment methodology is the Simplified Building Energy Model (SBEM). This assessment uses an advanced dynamic simulation modelling software – IES Virtual Environment - which enables accurate SBEM models to be created, as well as heat loss and cooling load calculations and full M&E design to be undertaken. The results are set out on a standard form known as BRUKL Output Document (**B**uilding Regulations **UK** Part **L**)

To consider the subject building performance against The Building Regulations (Approved Document L2A) SBEM first creates the notional reference building, the characteristics of which are defined within the National Calculation Method (NCM) and the minimum fabric values and fixed services efficiencies set down by AD L2A and the Non-Domestic Compliance Guide.

Fuel CO_2 emission factors and construction U-values based on the NCM document for Part L2A 2013 compliance have been applied to the model in order to calculate the CO_2 emissions that will be produced as a result of the running of the systems outlined within tables 3 and 4 below;

System	Fuel Source	Emission Factor ($KgCO_2/kWh$)
Heating	Oil	0.319
Cooling Energy	Grid Electricity	0.519
Lighting Energy	Grid Electricity	0.519
Pump / Fan Energy	Grid Electricity	0.519
DHW Energy	Oil	0.319

Table 1: Fuel Carbon Emission Factor

Table 1 Construction element U-values and thermal capacity for the Notional building		
Exposed element	**U-value (W/m²K)**	**Thermal capacity[6] (kJ/m²K)**
Roofs[7] (irrespective of pitch)	0.18	21.8 (1.40 if metal clad)
Walls	0.26	88.3 (1.40 if metal clad)
Exposed floors and ground floors (subject to paragraph 33)	0.22	ivity
Windows, roof windows, and roof lights[8]	1.80	-
Vehicle access and similar large doors	1.50	2.1
Pedestrian doors and high usage entrance doors	2.20	54.6
Internal wall	1.80	8.8
Internal floor / ceiling	1.00	71.8 from above / 66.6 from below

Table 2: Maximum Construction U-values.

3.1 Baseline Results

In order to establish the baseline, the HVAC solution has been assumed as an oil-fired boiler heating system (there being no gas on site) and natural ventilation. Domestic Hot Water (DHW) will be supplied from the boilers via appropriately sized calorifiers and a secondary circulation loop.

This creates the Target Emission Rate (TER) and should be considered as stage 'zero' of the energy hierarchy as described earlier and sets the benchmark for the worst performing, but legally permissible, development against which SBEM assesses the "actual" design, fabric values, heating lighting and ventilation systems and creates the Building Emissions Rate (BER).

The baseline building emissions for B1 and B2 have been calculated to be a total of 33,855 kgCO_2/annum as given in the Target Energy Rating (TER) of the BRUKL output at **Appendix A**.

3.2 Design for energy efficiency – "Be Lean"

The project is now to be considered against the first stage of the Energy Hierarchy which requires that buildings be designed to use improved energy efficiency measures – Be Lean. This will reduce demand for heating, cooling, and lighting, and therefore reduce operational costs while also minimizing associated carbon dioxide emissions.

This section sets out the measures included within the design of the development, to reduce the demand for energy, both gas and electricity (not including energy from renewable sources).

To achieve reductions in energy demand the following measures have been included within the design and specification of the building:

3.2.1 Passive Design

The National Planning Policy Framework emphasises the need to take account of climate change over the longer term and plan new developments to avoid increased vulnerability to the range of impacts arising from climate change. The UK Climate Impacts Programme 2009 projections suggest that by the 2080's the UK is likely to experience summer temperatures that are up to 4.2°C higher than they are today.

Accordingly, designers are to ensure buildings are designed and constructed to be comfortable in higher temperatures, without resorting to energy intensive air conditioning.

In line with current best practice, the buildings have been designed to ensure that they are not vulnerable to overheating;

- **minimise internal heat generation through energy efficient design**
  The project will be designed to best practice thermal insulation levels as noted, full details of which are noted under Table 3 below. Not only does good insulation assist in reducing heat losses in the winter, it has a significant impact on preventing heat travelling through the built fabric during the summer.

- **reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and wall**
  The development site is based within a rural location and the allocated area for the scheme has a southerly outlook. Glazing specification has been considered as part of the overheating risk and the specified new glazing will achieve a g-value of 0.4 or better to assist in reducing overheating risk from excessive solar gain. Internal blinds will be provided to control glare and to enhance solar shading performance.

- **manage the heat within the building through exposed internal thermal mass and high ceilings**
  The ground floors of B1 and B2 will have exposed concrete floors. The 1st floor rooms will have vaulted ceilings which will be lined with phase change boarding to provide the effects of thermal mass.

- **passive ventilation**
  A ll rooms will have opening windows. Rooflights will be provided to the upper floors and to B2 The Hub

- **mechanical ventilation**
  To enhance energy efficiency, mechanical ventilation with heat recovery (MVHR) will be used in toilets areas

3.2.2 Fabric heat loss

The insulation levels of the building fabric will exceed Building Regulations standards as follows

U-values (W/m^2K)	Current Building Regulations minimum*	Values for the proposed B1 Building	Values for the proposed B2 Building
Walls	0.35	0.20	0.13
Floors	0.25	0.18	0.13
Roofs	0.25	0.16	0.13
Opaque door	2.2	2.0	2.0
Windows and glazed doors	2.2	1.6	1.3
Air permeability	$10m^3/m^2h$ at 50 Pa	$3m^3/m^2h$ at 50 Pa	$3m^3/m^2h$ at 50 Pa

*=Simplified area weighted averages, Part L2A

Table 3: Thermal performance for the proposed building in comparison with the Base Case building

3.2.3 Lighting and appliances

The development will incorporate high efficiency light fittings utilising LED lamps and will have PIR and photocell controls (as appropriate) to minimise daytime/unnecessary use.

Back of house areas will also have an absence detection system to ensure lights cannot be left on when not in occupation.

The use of LED lighting will also minimise the internal gains commonly associated with tungsten and fluorescent lighting systems and thereby reduce cooling loads.

All appliances will be A-rated

3.2.4 Results following energy efficiency measures

Following application of the energy efficiency measures outlined above, the building emissions have been calculated to be 33,318 kgCO_2/annum, a reduction of 1.6% on the baseline model as given in the Building Energy Rating (BER) of the BRUKL output at **Appendix A**.

In terms of overheating risk, the building pass Part L 2013 Criterion 3 for overheating as indicated on the same BRUKL output documents.

3.3 Supplying energy efficiently

The second stage of the Energy Hierarchy requires the sustainable energy strategy to demonstrate how the development will meet national standards through connection to district energy networks or the application of Combined Heat and Power (CHP).

Clearly, as a development of a single building in a relatively remote location, there will be no access to any form of district heating or energy sources, nor would there be any viability in developing such a network in this rural location.

The use of a combined heat and power system would also be unsuitable in such a project where uses are intermittent and demand for hot water is low; the CHP would not be able to run for sufficient hours per year to achieve the appropriate CHP quality index.

The electrical grid in the UK has been decarbonising and is projected to continue doing so. This means using grid electricity becomes a lower carbon source of energy than gas. This favours electrically powered heating systems, and it makes CHPs no longer beneficial in carbon terms.

3.4 Low Carbon and Renewable Energy Options

The final element of the Energy Hierarchy requires development proposals to provide a reduction in expected carbon dioxide emissions through on-site renewable energy generation, where feasible – Be Green.

Each of the available technologies have been considered.

a) Photovoltaics

Photovoltaics (PV) panels convert solar energy into electricity. They must be in a generally southern facing orientation at ideally, 30° to the horizontal.

The proposed development is predominantly commercial offices with a steady regulated energy demand along with potentially high unregulated electricity demand. PV's would be a suitable zero carbon technology to assist with the achievement of the target emission reduction.

However, due to the sensitivity of views of the site in the landscape, the appearance of PV's is considered unacceptable.

b) Solar Hot Water

Solar thermal panels use free heat from the sun to warm the domestic hot water. They must be located in a generally south facing position, ideally at about 30° to the horizontal.

The scheme investigated is based on installing a nominal active area of high efficiency (evacuated tube) solar hot water panels, accommodated on the roof of the buildings. Such systems are relatively low maintenance, are a proven technology and are a visible indication of the development's green aspirations.

Although efficient and cost effective in implementation, solar hot water systems can only offset a fraction of the domestic hot water demand for the site, which is quite small compared to other energy demands. Also, as for PV's, due to the sensitivity of views of the site in the landscape, the appearance of solar thermal is considered unacceptable.

c) Biomass

Biomass heating using wood chip or wood pellet boilers has been considered. The space for a central boiler plant and fuel storage would require additional built footprint which cannot be accommodated due to the site being in the Green Belt. The installation and maintenance costs associated with serving several buildings deem this technology to be financially unfeasible.

d) Ground source heating

Ground source heating extracts heat from the ground, the carbon benefit being that considerably more heat energy is extracted than electrical energy is used to run the system. Whilst the generation of 1kW of electricity produces 2.6 times more CO2 than the burning of 1kW of gas, ground source systems can expect to produce at least 3 times more heat energy than the electrical energy put into them (known as the Coefficient of Performance or COP) and therefore produce less CO2 than the equivalent gas boiler. The system requires a connection to the general mass of the ground, either using an array of horizontal pipes buried in an open area (for example a field) or an array of vertical pipes contained within deep (perhaps 100M) boreholes. It is sometimes possible to utilise the ground piles of a building as vertical boreholes. A horizontal system requires a substantial area of land to collect heat – perhaps 90M2 / kW. The bores for a vertical system should be placed at least 5M apart, and a 100M borehole might produce 3kW.

The site is in a rural area with large footprint and open ground which makes ground source heating appropriate. However, due to the budget constraints this technology will not be pursued.

e) Air source heating

Air source heat pumps generate hot water for space heating systems using the energy in outdoor air, instead of the ground as for ground source heat pumps. They are less efficient than ground source, but are a low carbon technology as they use electricity as their primary energy source. This system is technically feasible for the site, and will be considered subject to budget availability.

f) Wind Turbines

Wind turbines produce electricity directly from the energy in wind. This is then fed into the buildings electrical system via a control gear. Two types of wind turbine are available; horizontal axis and vertical axis. The former tends to be noisy and produce vibration. The latter are quieter in operation and more suited to installation on buildings but are generally less efficient and more expensive.

Wind turbines can be quite large and impact the visual appeal of landscapes, and the blades may cause unacceptable noise levels. Given such impacts, it is considered that wind turbines would not be appropriate at this location.

g) Low Carbon Electricity

Since the grid is being continually de-carbonised, electricity it is now THE energy source which will enable the UK and the world to achieve a zero carbon future.

In this way, the carbon emission factors (SAP10.1) for grid electricity can be applied by to the energy consumption for the buildings to demonstrate a further reduction against the Base Building Target emissions.

Subject to budget availability for air source heat pumps described in Clause e) above, for the purposes of this application, the low carbon technology to be adopted will be electric heating and hot water, with electricity purchased from renewable energy suppliers to further reduce its environmental impact.

Using SAP10.1 carbon factors, the development achieves a 63% reduction in carbon emissions compared with Building Regulations 2013, significantly exceeding the SDC renewable energy target of 10%.

System	Energy Consumption (kWh/yr)	CO_2 Emission (kg/yr)	CO_2 Emission (kg/yr/m^2)	CO_2 Emission (kg/yr)	CO_2 Emission (kg/yr/m^2)
		SAP 2012		SAP 10.1	
Electric Heating	45,564	23,057	14.91	6,042	3.91
Cooling Energy	0	0	0	0	0
Lighting Energy	16,506	8,353	5.4	2,189	1.41
Pump/Fan Energy	335	169	0.11	44	0.03
DHW Energy	3,436	1,739	1.12	456	0.30
Total	**24,031**	**12,028**	**21.5**	**8,731**	**5.65**

Table 4: Regulated Carbon Dioxide Emissions Breakdown of B1&B2 combined

	Carbon dioxide emissions for non-domestic buildings (Tonnes CO2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulation Compliant Development	26.14	12.11
After energy demand reduction	25.72	12.11
After Heat network/CHP	n/a	12.11
After Low Carbon/Renewables (SAP10.1)	8.73	7.07

	Regulated non-domestic Carbon dioxide Savings	
	Tonnes CO2 per annum	Percentage
Savings from energy demand reduction	0.42	1.6%
Savings from heat network/CHP	n/a	n/a
After Low Carbon/Renewables (SAP10.1)	12.4	62.9%

Table 5: Total Carbon Dioxide reduction summary

The Sevenoaks local policy requires a 10% reduction of CO2 on site. The proposed development with SAP 10.1 carbon factors achieves an average of 62.9% across the two buildings

4.0 SUSTAINABLE DESIGN & CONSTRUCTION

4.1 BREEAM New Construction 2018

The development will be designed to meet BREEAM “Very Good”.

To achieve this, particular attention will be paid to the following:

4.2 Energy efficiency

These matters have been dealt within the Energy Statement in the previous Sections.

4.3 Materials

The design team have put a strong focus on sustainability and durability when considering construction profiles and building materials for the development. High Green Guide ratings will be achieved wherever possible and materials will be assessed for suitability with regards to Whole Life Costs.

Insulating materials will be specified to maximise thermal performance whilst still paying attention to the environmental impact of the materials used. The use of recycled products will be pursued wherever feasible and the use of other low embodied energy products will be further investigated.

Responsible sourcing will also be pursued. All timber used on site during the construction phase and within the building will be from FSC sources or equivalent. Other materials, including insulation, will be sourced from manufacturers who employ environmental management systems such as ISO 14001 or BES 6001. Where possible, materials will be sourced locally.

Non-toxic materials will be used wherever possible, including the specification of products with low VOC content in line with European testing standards.

A Site Waste Management Plan (SWMP) will be produced for the site, which will determine how to maximise the recovery of materials from the enabling works for subsequent high-grade/value applications as noted under 7.2.

4.4 Pollution

a) Plant and machinery

There will be no plant in the development emitting pollutant gases or particulates.

b) Operational impacts

The use of electric heating systems will have no impact on local air quality.

The proposed building use will not involve the storage, processing or transfer of hazardous substances.

c) Noise pollution

There is no major external plant that could cause a noise nuisance.

4.5 Water quality, saving and drainage

Water consumption

Internal potable water use will be limited through the specification of low flow fittings and dual flush toilets. All white goods provided will have maximum water efficiency ratings.

The following specifications will be considered to meet the water consumption target:

- Basin Taps - 5l/min

- WCs – 5/2.6 litre flush
- Kitchen taps – 7.5l/min
- Showers – 9l/min

4.6 Light pollution

The development is in a rural location, therefore can contribute to increasing the effects of light pollution. The design team will follow the appropriate ILE design guidance with a view to achieving compliance.

4.7 Waste and recycling

The recycling of operational waste once the building is occupied will be encouraged through the provision of recycling facilities and dedicated internal and external storage for recyclable materials, separate to those for domestic refuse.

4.8 Sustainable Drainage, Ecology and Transport

Separate reports to be provided

5.0 CONCLUSION

This report has detailed the baseline energy requirements for the proposed development, the reduction in energy demand because of energy efficiency measures and the potential to achieve further CO_2 reductions using low carbon electricity as the prime energy source. The will be no fossil fuel utilised within the scheme.

The introduction of passive energy efficiency measures, as detailed in section 3, result in a reduction of carbon emissions of 1.6% on the calculated baseline energy requirement.

There is a requirement to provide 10% of the on-site energy by low carbon or renewable technologies. The most appropriate and financially feasible technology has been assessed as being the utilisation of grid electricity which is increasingly being decarbonised.

The total reduction in emissions compared with the baseline target is **62.9%.**

The development will undergo a BREEAM assessment to demonstrate that the proposals are able to achieve a Very Good Rating.

This report demonstrates that the proposed development complies with Core Strategy Policy SP1.

Appendix A – BRUKL Output Document

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Hatchery

BUILDING B1

As designed

Date: Wed Nov 25 10:55:27 2020

Administrative information

Building Details

Address: Preston Farm, Sevenoaks, TN

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	20.8
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	20.8
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	20.3
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.19	0.2	B1000000:Surf[3]
Floor	0.25	0.18	0.18	B1000000:Surf[0]
Roof	0.25	0.16	0.16	B1000013:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.65	1.67	B1000014:Surf[0]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- Main system

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

1- Main system

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
B1 - GF Dis WC	-	-	0.4	-	-	-	-	-	-	-	N/A
B1 - GF Toilets1	-	-	0.4	-	-	-	-	-	-	-	N/A
B1 - GF WC2	-	-	0.4	-	-	-	-	-	-	-	N/A
B1 - GF WC1	-	-	0.4	-	-	-	-	-	-	-	N/A
B1 - GF Toilet2	-	-	0.4	-	-	-	-	-	-	-	N/A
B1 - FF Dis WC	-	-	0.4	-	-	-	-	-	-	-	N/A
B1 - FF Toilets1	-	-	0.4	-	-	-	-	-	-	-	N/A
B1 - FF Toilet2	-	-	0.4	-	-	-	-	-	-	-	N/A
B1 - FF WC1	-	-	0.4	-	-	-	-	-	-	-	N/A
B1 - FF WC2	-	-	0.4	-	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
B1 - GF South Meeting room	80	-	-	384
B1 - GF South openoffice1	79	-	-	370

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
B1 - GF South Office1	96	-	-	90
B1 - GF South Office2	96	-	-	92
B1 - GF South Office3	96	-	-	91
B1 - GF South Office4	96	-	-	91
B1 - GF South Corridor	-	50	-	172
B1 - GF South openoffice2	81	-	-	264
B1 - GF Dis WC	-	113	-	39
B1 - GF North office1	85	-	-	167
B1 - GF North openoffice1	76	-	-	656
B1 - GF Toilets1	-	85	-	93
B1 - GF WC2	-	118	-	35
B1 - GF WC1	-	118	-	35
B1 - GF Toilet2	-	84	-	96
B1 - GF North Corridor	-	66	-	198
B1 - FF Entrance	75	-	-	564
B1 - FF South openoffice1	83	-	-	370
B1 - FF South Office1	115	-	-	90
B1 - FF South Corridor	-	103	-	163
B1 - FF South Meeting room	84	-	-	384
B1 - FF South openoffice2	87	-	-	264
B1 - F South Office2	114	-	-	92
B1 - FF South Office3	114	-	-	91
B1 - FF South Office4	114	-	-	91
B1 - FF North Corridor	-	101	-	189
B1 - FF North office1	95	-	-	167
B1 - FF North openoffice1	77	-	-	656
B1 - FF North office2	96	-	-	165
B1 - FF North office2	96	-	-	165
B1 - FF North openoffice2	89	-	-	248
B1 - FF Dis WC	-	127	-	39
B1 - FF Toilets1	-	108	-	93
B1 - FF Toilet2	-	107	-	96
B1 - FF WC1	-	131	-	35
B1 - FF WC2	-	131	-	35
B1 - GF Entrance	-	127	15	294
B1 - GF North openoffice2	80	-	-	306
B1 - GF North office2	82	-	-	248

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
B1 - GF South Meeting room	NO (-96%)	YES
B1 - GF South openoffice1	NO (-95.6%)	YES
B1 - GF South Office1	NO (-93.3%)	YES

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
B1 - GF South Office2	NO (-93.5%)	YES
B1 - GF South Office3	NO (-93.4%)	YES
B1 - GF South Office4	N/A	N/A
B1 - GF South openoffice2	NO (-94.1%)	YES
B1 - GF North office1	NO (-93.4%)	YES
B1 - GF North openoffice1	NO (-96.9%)	YES
B1 - FF Entrance	NO (-78.7%)	YES
B1 - FF South openoffice1	NO (-88.7%)	YES
B1 - FF South Office1	NO (-84%)	YES
B1 - FF South Meeting room	NO (-92.4%)	YES
B1 - FF South openoffice2	NO (-89.5%)	YES
B1 - F South Office2	NO (-84.5%)	YES
B1 - FF South Office3	NO (-84.3%)	YES
B1 - FF South Office4	N/A	N/A
B1 - FF North office1	NO (-88.1%)	YES
B1 - FF North openoffice1	NO (-94.5%)	YES
B1 - FF North office2	NO (-90.4%)	YES
B1 - FF North office2	NO (-90.3%)	YES
B1 - FF North openoffice2	NO (-87.6%)	YES
B1 - GF Entrance	NO (-75.7%)	YES
B1 - GF North openoffice2	NO (-95.8%)	YES
B1 - GF North office2	NO (-94.8%)	YES

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	1040.1	1040.1
External area [m²]	1810.4	1843.3
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	578.13	770.55
Average U-value [W/m²K]	0.32	0.42
Alpha value* [%]	10.1	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	25.69	33.2
Cooling	0	0
Auxiliary	0.19	0.29
Lighting	12	18.31
Hot water	2.15	2.36
Equipment*	33.75	33.75
TOTAL**	**40.03**	**54.16**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	92.49	103.05
Primary energy* [kWh/m²]	119.83	94.79
Total emissions [kg/m²]	20.3	20.8

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	92.5	0	25.7	0	0.2	1	0	1	0
	Notional	103	0	33.2	0	0.3	0.86	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.02	B100000D:Surf[8]
Floor	0.2	-	B1000027:Surf[6]
Roof	0.15	0.16	B1000013:Surf[0]
Windows, roof windows, and rooflights	1.5	1.65	B1000000:Surf[1]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Hatchery

BUILDING B2

As designed

Date: Wed Nov 25 10:38:36 2020

Administrative information

Building Details

Address: Preston Farm, Sevenoaks, TN

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	24.2
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	24.2
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	24.2
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.13	0.13	B2000000:Surf[2]
Floor	0.25	0.13	0.13	B2000000:Surf[21]
Roof	0.25	0.13	0.13	B2000000:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.36	1.67	B2000000:Surf[4]
Personnel doors	2.2	2.2	2.2	B2000009:Surf[4]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- Main system

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

1- Main system

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
B2 - Dis WC	-	-	0.4	-	-	-	-	-	-	-	N/A
B2 - WC2	-	-	0.4	-	-	-	-	-	-	-	N/A
B2 - WC1	-	-	0.4	-	-	-	-	-	-	-	N/A
B2 - WC3	-	-	0.4	-	-	-	-	-	-	-	N/A
B2 - WC4	-	-	0.4	-	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
B2 - Hub	99	-	-	1897
B2 - Store2	120	-	-	9
B2 - Dis WC	-	181	-	40
B2 - WC2	-	181	-	25
B2 - WC1	-	181	-	25
B2 - WC3	-	181	-	26
B2 - WC Lobby	-	119	-	57

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
B2 - Store1	117	-	-	7
B2 - WC4	-	181	-	25
B2 - Circulation area	-	88	-	229
B2 - Office	105	-	-	596

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
B2 - Hub	NO (-79.9%)	YES
B2 - Office	NO (-93%)	YES

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	506.5	506.5
External area [m²]	1420.3	1420.3
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	331.24	478.22
Average U-value [W/m²K]	0.23	0.34
Alpha value* [%]	10	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	37.21	47.29
Cooling	0	0
Auxiliary	0.27	0.3
Lighting	7.95	16.12
Hot water	2.37	2.6
Equipment*	35.93	35.93
TOTAL**	**47.79**	**66.32**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	133.96	146.76
Primary energy* [kWh/m²]	143.06	104.06
Total emissions [kg/m²]	24.2	24.2

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	134	0	37.2	0	0.3	1	0	1	0
	Notional	146.8	0	47.3	0	0.3	0.86	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.13	B2000000:Surf[2]
Floor	0.2	0.13	B2000000:Surf[21]
Roof	0.15	0.13	B2000000:Surf[0]
Windows, roof windows, and rooflights	1.5	1.33	B2000000:Surf[1]
Personnel doors	1.5	2.2	B2000009:Surf[4]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3